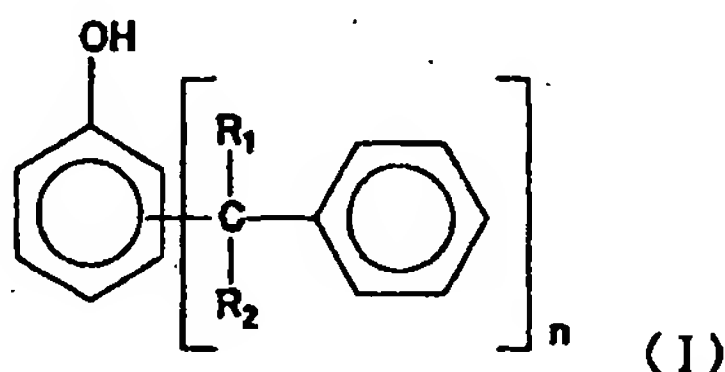


## Claims

1. A thermosetting resin composition comprising:

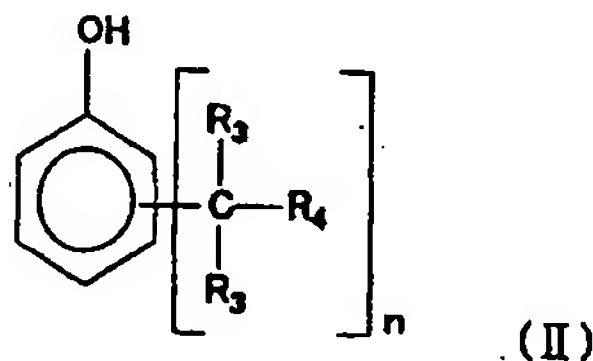
5 (A) a phenol-modified cyanate ester oligomer that is the reaction product of (a) a cyanate compound containing two or more cyanato groups in a single molecule, and (b) a phenol compound containing at least one member selected from a phenol compound represented by the formula (I):



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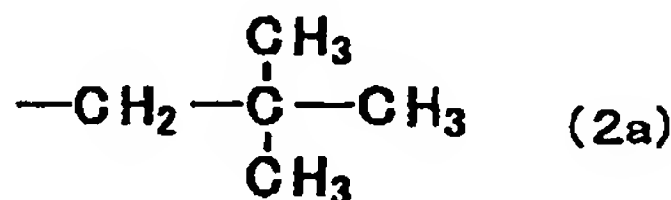
wherein R<sub>1</sub> and R<sub>2</sub> independent of each other represent a hydrogen atom or a methyl group, and may be respectively the same or different from each other, and *n* represents an integer of 1 or 2,

15 and a phenol compound represented by the formula (II):



20

wherein R<sub>3</sub> independent of each other represent a hydrogen atom or a methyl group, and may be respectively the same or different from each other, R<sub>4</sub> represents an alkyl group selected from a methyl group, an ethyl group or a group (2a):



25 and *n* represents an integer of 1 or 2, and which is obtained by reacting such that a blending equivalence ratio of (b) hydroxyl group / (a) cyanato group is within a range of 0.01 to 0.3, and a monomer conversion

rate of the cyanate compound (a) containing two or more cyanato groups in a single molecule is 20 to 70%;

(B) an epoxy resin containing two or more epoxy groups within a single molecule; and,

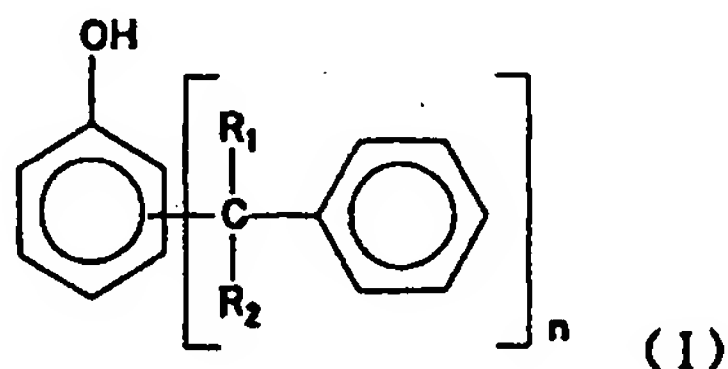
5 (C) at least one member selected from a metal salt of a di-substituted phosphinic acid and a phosphazene compound as a flame retardant.

2. A thermosetting resin composition according to  
10 claim 1 wherein the phenol-modified cyanate ester oligomer of (A) is a phenol-modified cyanate ester oligomer obtained by reacting with phenol compound (b) so that the monomer conversion rate of the cyanate compound (a) containing two or more cyanate groups in a single molecule  
15 is 45 to 65%.

3. A thermosetting resin composition comprising: (A1) a cyanate compound containing two or more cyanato groups in a single molecule, (B) an epoxy resin containing two or  
20 more epoxy groups within a single molecule, (C) at least one member selected from a metal salt of a di-substituted phosphinic acid and a phosphazene compound, (D) a silicone polymer containing at least one member of siloxane unit selected from a tri-functional siloxane unit represented  
25 by the formula:  $\text{RSiO}_{3/2}$  (wherein R represents an organic group, and the R groups in the silicone polymer may be mutually the same or different) and a tetra-functional siloxane unit represented by the formula:  $\text{SiO}_{4/2}$ , having a degree of polymerization of 7,000 or less, and having one  
30 or more functional groups on its terminals that react with hydroxyl groups, and (E) an inorganic filler.

4. A thermosetting resin composition according to  
claim 3 wherein (A1) a cyanate compound containing two or  
35 more cyanato groups in a single molecule is a phenol-modified cyanate ester oligomer that is the reaction

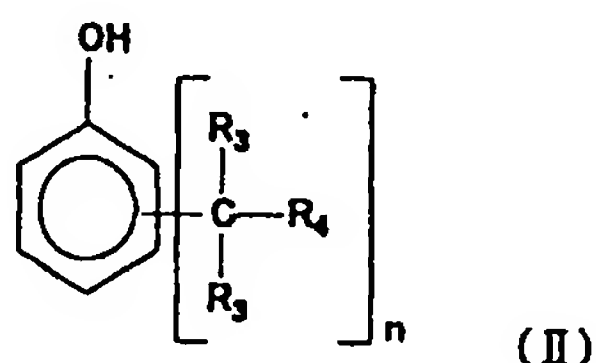
product of (a) a cyanate compound containing two or more cyanato groups in a single molecule, and (b) a phenol compound containing at least one member selected from a phenol compound represented by the formula (I):



5

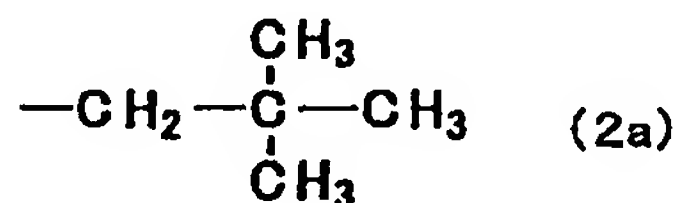
wherein  $\text{R}_1$  and  $\text{R}_2$  independent of each other represent a hydrogen atom or a methyl group, and may be respectively the same or different from each other, and  $n$  represents an integer of 1 to 3,

10 and a phenol compound represented by the formula (II):



15

wherein  $\text{R}_3$  independent of each other represent a hydrogen atom or a methyl group, and may be respectively the same or different from each other,  $\text{R}_4$  represents an alkyl group selected from a methyl group, an ethyl group or a group (2a):



and  $n$  represents an integer of 1 or 2,

20 and which is reacted such that a blending equivalence ratio of (b) hydroxyl group/ (a) cyanato group is within a range of 0.01 to 0.3, and the monomer conversion rate of the cyanate compound (a) containing two or more cyanato groups in a single molecule is 20 to 70%.

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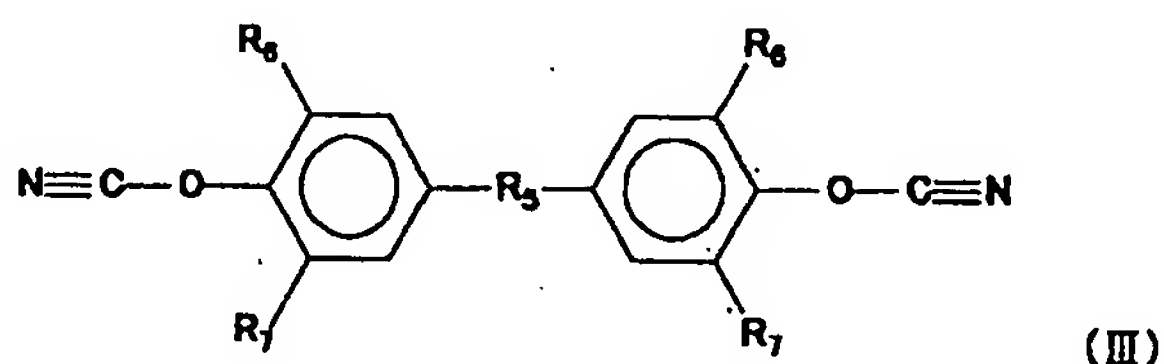
5. A thermosetting resin composition according to any of claims 1 to 4 wherein the number average molecular

weight of the phenol-modified cyanate ester oligomer of (A) or the cyanate compound containing two or more cyanato groups in a single molecule of (A1) is 380 to 2500.

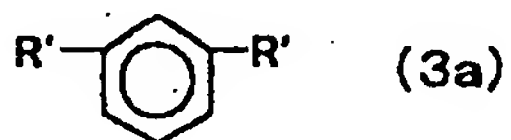
- 5 6. A thermosetting resin composition according to any of claims 1 to 4 wherein the number average molecular weight of the phenol-modified cyanate ester oligomer of (A) or the cyanate compound containing two or more cyanato groups in a single molecule of (A1) is 400 to 1600.

10

7. A thermosetting resin composition according to any of claims 1, 2 or 4 wherein the phenol-modified cyanate ester oligomer of (A) or the cyanate compound containing two or more cyanato groups in a single molecule of (A1) contains at least one member of cyanate compound selected from compounds represented by the formula (III):



- 20 wherein R<sub>5</sub> represents an alkylene group having 1 to 3 carbon atoms that may or may not be substituted with a halogen, the formula (3a) or formula (3b):

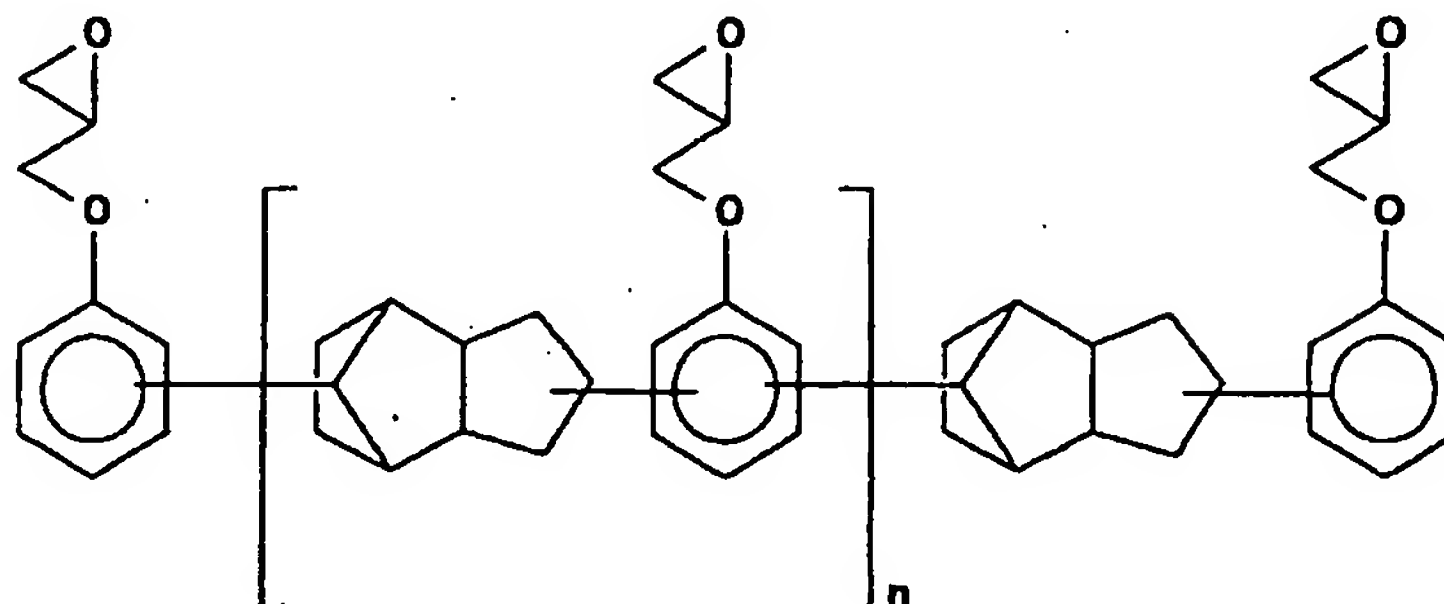


and R<sub>6</sub> and R<sub>7</sub> represent hydrogen atoms or alkyl groups having 1 to 3 carbon atoms and R' represent alkyl groups having 1 to 4 carbon atoms.

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8. A thermosetting resin composition according to any of claims 1 to 4 wherein the epoxy resin containing two or more epoxy groups in a single molecule of (B) contains at

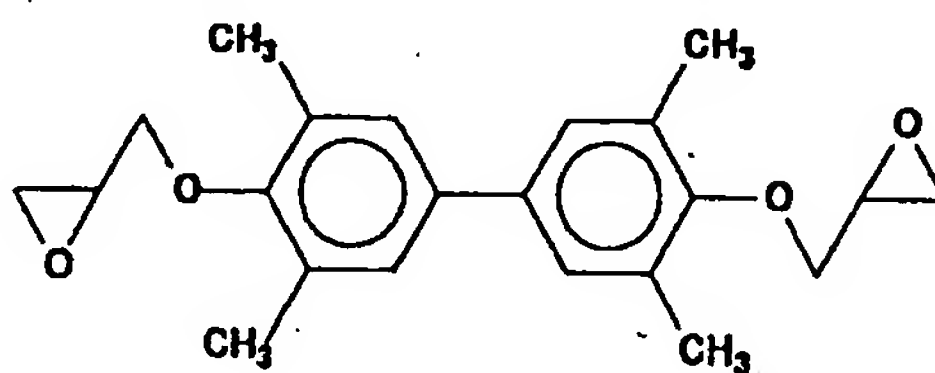
least one member selected from an epoxy resin derived from a dicyclopentadiene-phenol heavy addition product containing a dicyclopentadiene backbone represented by the formula (IV):



(IV)

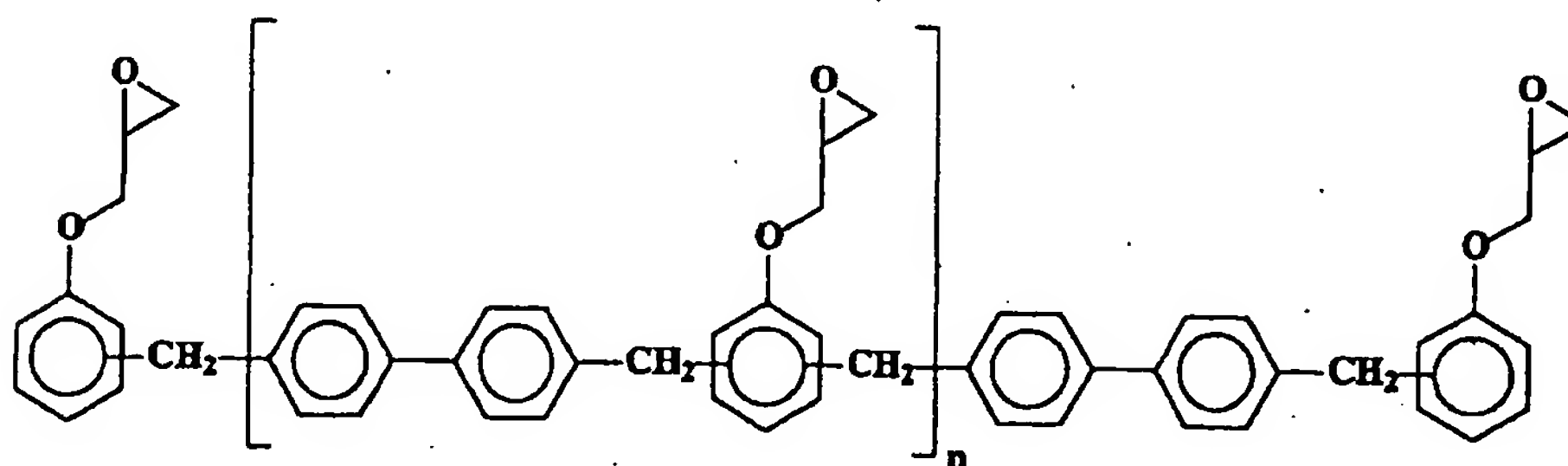
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wherein n represents 0 or an integer,  
a biphenyl epoxy resin represented by the formula (V):



(V)

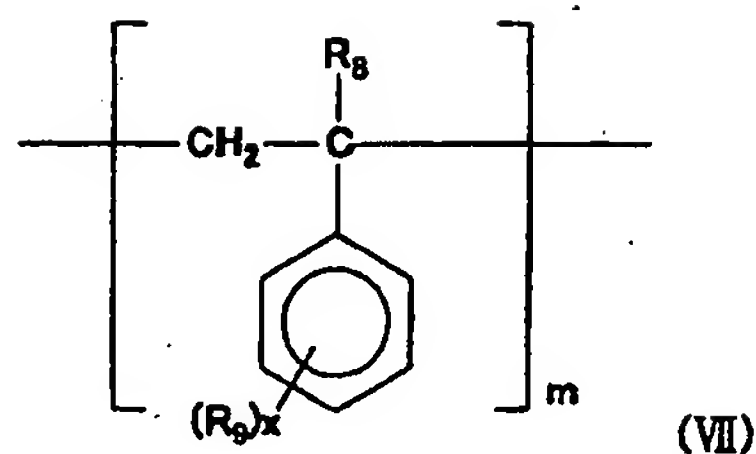
and a biphenyl aralkyl Novolak epoxy resin represented by  
10 the formula (VI):



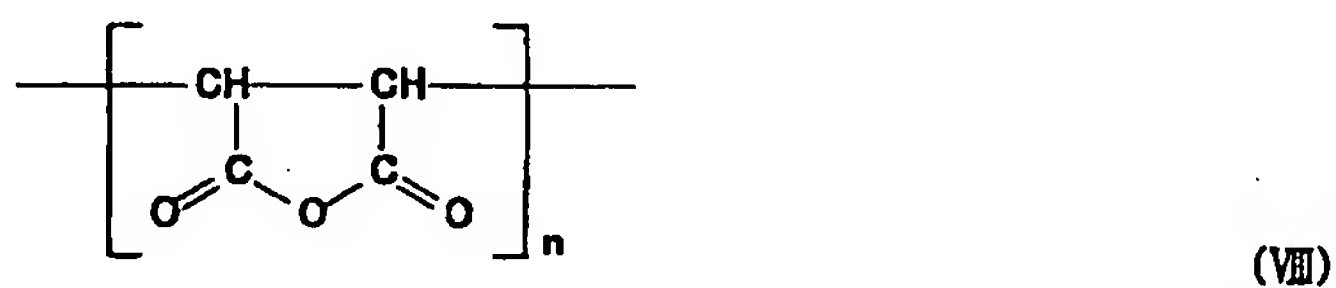
(VI)

wherein n represents an integer of 1 to 10.

9. A thermosetting resin composition according to any  
15 of claims 1 to 4 that additionally contains a copolymer resin containing a monomer unit represented by the formula (VII):



wherein  $\text{R}_8$  represents a hydrogen atom, halogen atom or monovalent hydrocarbon group having 1 to 5 carbon atoms,  $\text{R}_9$  respectively and independently represents a halogen atom, monovalent aliphatic hydrocarbon group having 1 to 5 carbon atoms or monovalent aromatic hydrocarbon group,  $x$  represents an integer of 0 to 3, and  $m$  represents a natural number, and a monomer unit represented by the formula (VIII):



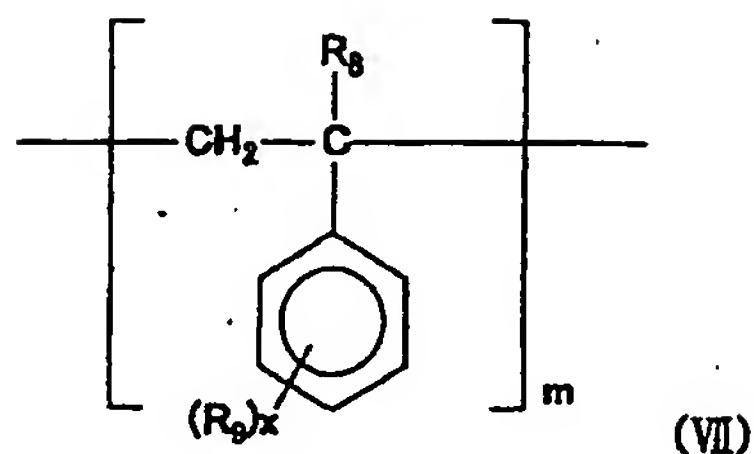
wherein  $n$  represents a natural number.

10. A thermosetting resin composition according to claim 3 or 4 that is used by surface treating the inorganic filler of (E) with the silicone polymer of (D) containing at least one member of siloxane unit selected from a tri-functional siloxane unit represented by the formula:  $\text{RSiO}_{3/2}$  (wherein,  $\text{R}$  represents an organic group, and the  $\text{R}$  groups in the silicone polymer may be mutually the same or different) and a tetra-functional siloxane unit represented by the formula:  $\text{SiO}_{4/2}$ , having a degree of polymerization of 7,000 or less, and having one or more functional groups on its terminals that react with hydroxyl groups.

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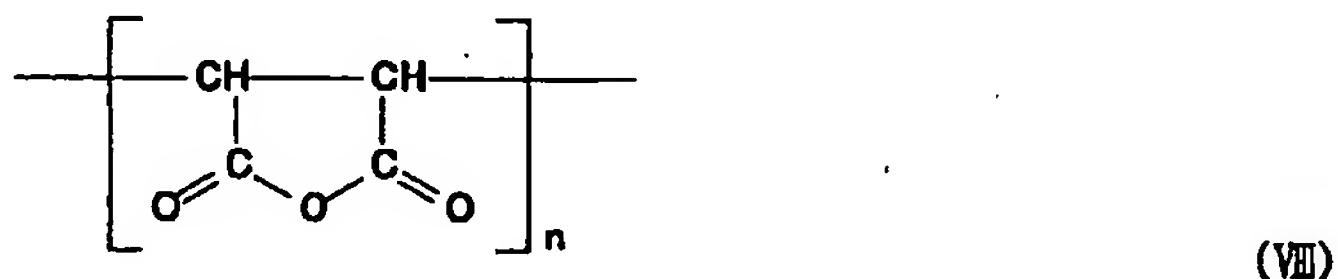
11. A thermosetting resin composition according to any of claims 1 to 4 that additionally contains a copolymer resin containing a monomer unit represented by the formula

(VII):



wherein  $\text{R}_8$  represents a hydrogen atom, halogen atom or hydrocarbon having 1 to 5 carbon atoms,  $\text{R}_9$  respectively and independently represents a halogen atom, an aliphatic hydrocarbon group having 1 to 5 carbon atoms or an aromatic hydrocarbon group,  $x$  represents an integer of 0 to 3, and  $m$  represents a natural number,

and a monomer unit represented by the formula (VIII):

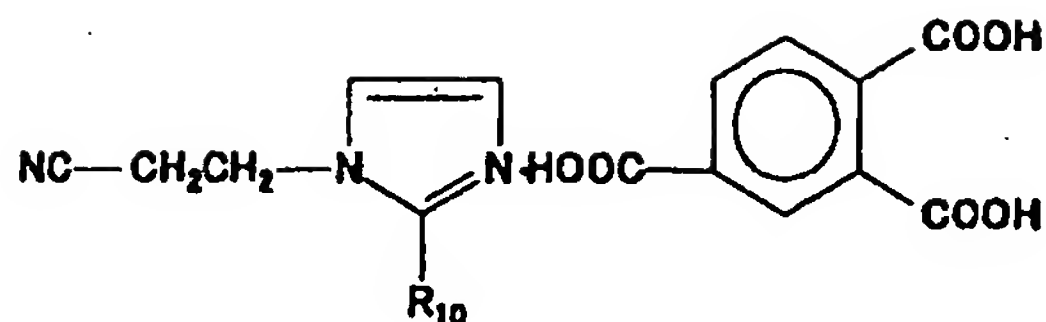


wherein  $n$  represents a natural number.

12. A thermosetting resin composition according to any of claims 1 to 4 that additionally contains as a curing accelerator (G) at least one member selected from the group consisting of organometallic salts and organometallic complexes of iron, copper, zinc, cobalt, nickel, manganese and tin, and an imidazole compound and acid addition salts thereof.

13. A thermosetting resin composition according to any of claims 1 to 4 that additionally contains as curing accelerator (G) at least one member selected from the group consisting of organometallic salts and organometallic complexes of iron, copper, zinc, cobalt, nickel, manganese and tin, and an imidazole compound and acid addition salts thereof represented by the formula

(IX):



wherein  $R_{10}$  represents an alkyl group having 1 to 11 carbon atoms or a benzene ring.

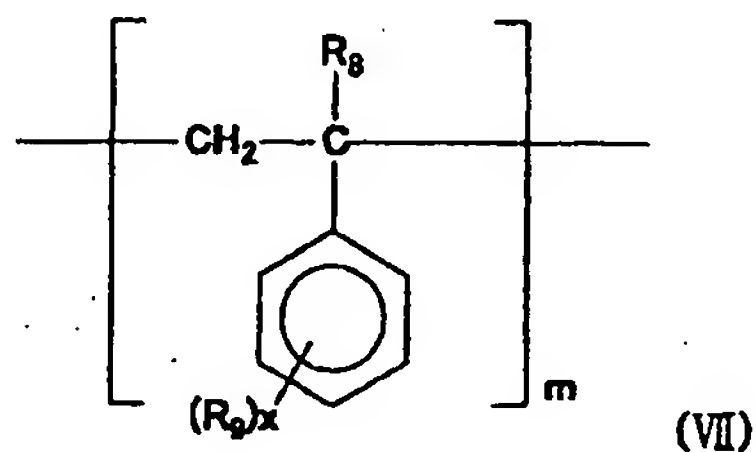
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14. A thermosetting resin composition according to any of claims 1 to 4 that additionally contains as an antioxidant (H) one member of phenol-based antioxidant or organosulfur compound-based antioxidant.

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15. A thermosetting resin composition according to claim 1 containing: 25 to 300 parts by weight of (B), 10 to 150 parts by weight of (C),

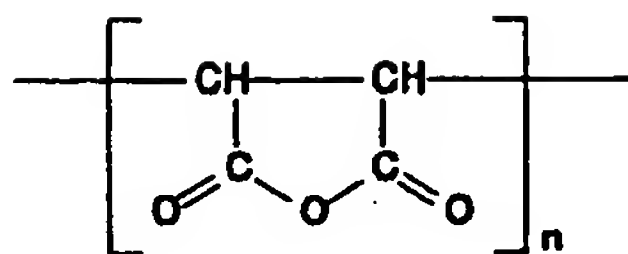
10 to 200 parts by weight of a copolymer resin (F) containing a monomer unit represented by the formula (VII):



wherein  $R_8$  represents a hydrogen atom, halogen atom or hydrocarbon having 1 to 5 carbon atoms,  $R_9$  respectively and independently represents a halogen atom, an aliphatic hydrocarbon group having 1 to 5 carbon atoms or an aromatic hydrocarbon group,  $x$  represents an integer of 0 to 3, and  $m$  represents a natural number,

25 and a monomer unit represented by the formula (VIII):





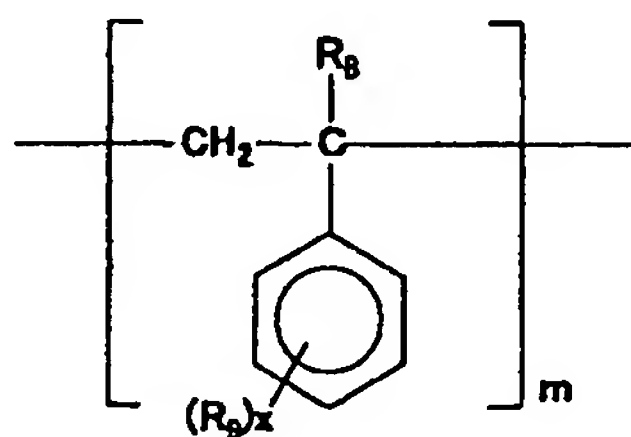
(VII)

wherein n represents a natural number,

0.1 to 5 parts by weight as the total weight of at least one member selected from the group consisting of organometallic salts and organometallic complexes of iron, copper, zinc, cobalt, nickel, manganese and tin, and an imidazole compound and acid addition salts thereof as curing accelerator (G), and 0.1 to 20 parts by weight of at least one member of phenol-based antioxidant or organosulfur compound-based antioxidant as antioxidant (H) based on 100 parts by weight of (A).

16. A thermosetting resin composition according to claim 3 containing: 25 to 300 parts by weight of (B), 10 to 150 parts by weight of (C), 0.025 to 60 parts by weight of (D), 50 to 300 parts by weight of (E),

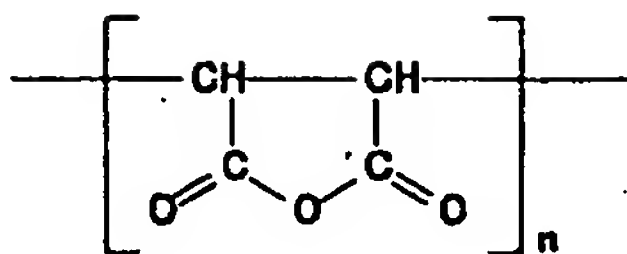
10 to 200 parts by weight of a copolymer resin (F) containing a monomer unit represented by the formula (VII):



(VII)

wherein R<sub>8</sub> represents a hydrogen atom, halogen atom or hydrocarbon having 1 to 5 carbon atoms, R<sub>9</sub> respectively and independently represents a halogen atom, an aliphatic hydrocarbon group having 1 to 5 carbon atoms or an aromatic hydrocarbon group, x represents an integer of 0 to 3, and m represents a natural number,

and a monomer unit represented by the formula (VIII):



(VII)

wherein n represents a natural number,  
and

0.1 to 5 parts by weight as the total weight of at  
least one member selected from the group consisting of  
organometallic salts and organometallic complexes of iron,  
copper, zinc, cobalt, nickel, manganese and tin, and an  
imidazole compound and acid addition salts thereof as  
curing accelerator (G),

based on 100 parts by weight of (A1).

17. A prepreg obtained by producing a varnish from a  
thermosetting resin composition according to any one of  
claims 1 to 4, impregnating on a base material and drying.

18. A metal-clad laminated board obtained by producing  
a varnish from a thermosetting resin composition according  
to any one of claims 1 to 4, impregnating the varnish on a  
base material, curing the impregnated base material till  
B-stage to form a prepreg, and layering and hot pressing  
one or a plurality of the prepreg with a metal foil on one  
side or metal foils on the top and bottom to form a metal-  
clad laminated board.

19. A wiring board obtained by producing a varnish from  
a thermosetting resin composition according to any one of  
claims 1 to 4, impregnating the varnish on a base material,  
curing the impregnated base material till B-stage to form  
a prepreg, layering and hot pressing one or a plurality of  
the prepreg with a metal foil on one side or metal foils  
on the top and bottom to form a metal-clad laminated board,  
and forming circuits on the metal-clad laminated board.